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Event attribution of climate change impacts on child undernutrition via crop production in India

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Child undernutrition is a major global concern, contributing to both mortality and lifelong morbidity. In low-income countries heavily reliant on subsistence and rainfed agriculture, low productivity agriculture affecting both food availability and income is one crucial factor influencing child nutrition. An increasing number of attribution studies have quantified impacts of human-induced climate change on crop yields in rainfed agriculture. Tracing the effect of these climate change impacts further to observed nutrition-related health outcomes is a gap in the attribution literature.

Here, we show an approach to attribute undernutrition-related child health impacts of anthropogenic climate change using a multidisciplinary array of data and methods. As a case study, we use India, which has one of the highest global burdens of undernutrition-related child health impacts. As observational data, we use 1) climate reanalysis data (W5E5), evaluated against observational products and weather station data; 2) district-level seasonal crop yield and production data for major staple crops; and 3) individual-level anthropometric and socioeconomic data from two waves of the Demographic and Health Surveys (DHS).

These data are used to bias-correct and statistically downscale large-ensemble climate model output from the CMIP6-DAMIP project, to calibrate perturbed-parameter ensembles of three different process-based crop models (APSIM, DSSAT, InfoCrop), and to estimate exposure-response functions linking crop yield anomalies to child health. Factual (with climate change) and counterfactual (without climate change) child health outcomes are then derived by applying this analysis chain to factual and counterfactual CMIP6-DAMIP data, respectively, and analysed in an event attribution framework to quantify the contribution of anthropogenic climate change to the 2014-2015 crop yield deficits and resulting child health impacts across India.

The 2014-2015 period saw substantial crop yield deficits across India, with seasonal yields falling more than two standard deviations below long-term trends. Epidemiological analysis reveals that children exposed to such deficits during prenatal and infancy periods face elevated stunting risk, while positive yield anomalies show no corresponding benefit. Attribution findings will be presented and wider implications for climate-food-health attribution and for applications of impact event attribution frameworks be discussed.